

# **Design Mobile App to Help Prevent Pressure Ulcers in Wheelchair Bound Patients**

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## **1. Introduction**

National Pressure Ulcer Advisory Panel, European Pressure Ulcer Advisory Panel and Pan Pacific Pressure Injury Alliance defines a pressure ulcer (PU) is a localized injury to the skin and/or underlying tissue usually over a bony prominence, as a result of pressure, or pressure in combination with shear.<sup>1</sup> In order to seek a prevention for pressure ulcer, an assistive technology mobile application will be designed to provide weight shifting exercises to help patients reduce risk of developing decubitus ulcer. These exercises include a forward lean, sideways lean, and a wheelchair pushup will result in very large reductions in interface pressure and significant increases in buttock blood flow.<sup>2</sup>

Other methods for preventing PU include moisture management, nutrition support, and skin inspection.<sup>3</sup> Together with the weight shifting exercises, these strategies will be included as an educational section of the app to provide patients with a tool to increase knowledge on how to avoid PU.

**Keywords: pressure ulcer, prevention, skin inspection, weight shifting exercises.**

## **2. Methodology**

Nowadays, mobile devices are becoming more and more important due to the advantage of portability, wireless connection, and small weight. For these reasons, mobile devices are becoming an indispensable part in our daily life. Additionally, more and more supportive mobile apps are being developed to help improve life quality. Hence, mobile devices and their applications are becoming more and more important, which will also offer a great change in healthcare management area. The iOS platform developed by Apple will be chosen to develop the mobile app to help patients perform weight shifting exercises and provide them with education documents for self inspection and prevention. The app will be written in Objective-C programming language with Xcode as the integrated development environment.

The app was designed to have 2 parts:

- 1- Weight shifting exercises
- 2- Educational documents

The objectives of the app are:

- Make a schedule to notify patients to do weight shifting exercises.
- Monitor the patient's movements using the built-in accelerometer in the mobile device to verify that the patient is doing exercises.
- Save the patients exercise log for further research.
- Provide information on pressure ulcers for education and self-prevention through skin inspection and so on.

The app was designed to give the therapist options of setting the app to provide the patient with notifications every 15, 30, or 45 minutes. Given that the accelerometer is a built-in instrument available in every mobile devices nowadays, the app uses it as a way to track the patient's displacement in position over a small amount of time to verify that the patient is doing exercises. After finishing the exercises, the app will save the data and store it on a cloud so that the therapist can extract it later for further research. The data will help therapist understand the relationship between pressure ulcers and the its development duration. Equally important, it will clarify whether these weight shifting exercises help reduce and prevent ulcers from developing.

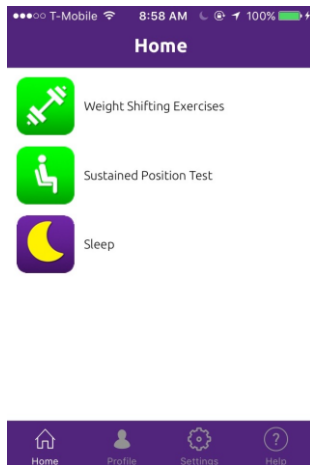


Fig 1

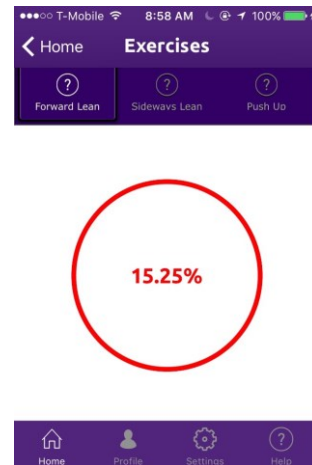


Fig 2

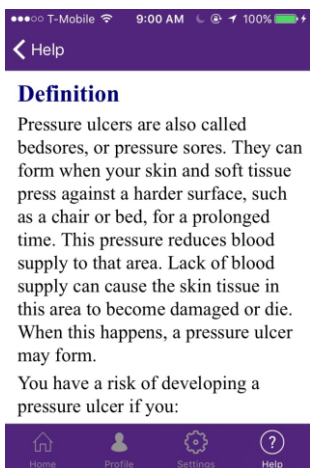


Fig 3

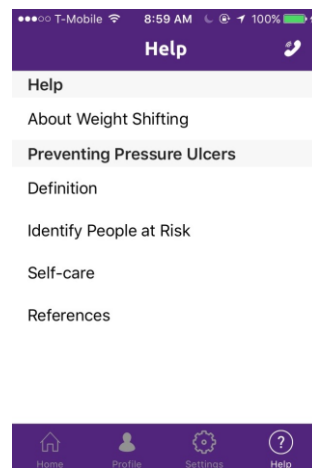


Fig 4

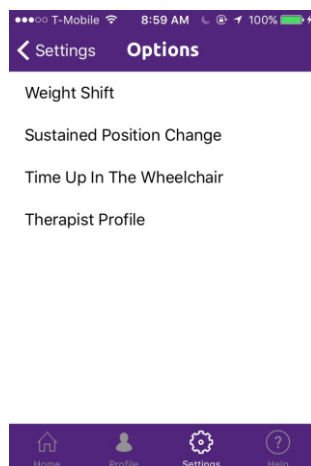


Fig 5

The app has the following features shown in the figures above:

Fig 1. The app has exercises including forward lean, sideways lean, wheelchair pushup, and sustained position test.

Fig 2. Three different weight shifting exercises with the accelerometer as an instrument to track the movement of the patient.

Fig 3. Documents to educate the patient on self-prevention and skin-inspection.

Fig 4. Communication feature to help the patient contact their therapist.

Fig 5. Different options for setting up the exercises.

### **3. Results and Conclusions**

After the app is tested by the therapists, several issues were exposed and therefore, required further research and implementation of the app. One of these issues was the inability of the accelerometer to monitor sideways lean exercise. As a result, in the next phase of the research, the app will not rely on the accelerometer. In addition, the development will make use of a pressure map as another way to track the movements of the patient. Thus, this new approach is hoped to be more effective than the use of the accelerometer and the next phase of the research will be started in Summer 2016.

### **4. References**

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